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REPORT OF

FOREST INSECT DETECTION SURVEYS

IN OREGON AND WASHINGTON

Season of 1950

By

Oregon State Board of Forestry

and

Bureau of Entomology and Plant Quarantine

United States Department of Agriculture

Forest Insect Laboratory
445 U. S. Court House
Portland 5, Oregon
September 30, 1950

Staff. FPK

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH ADMINISTRATION
BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Forest Insect Laboratory
445 U. S. Court House
Portland 5, Oregon
October 6, 1950

Mr. F. P. Keen
29 Forestry Building
University of California
Berkeley 4, California

Dear Paul:

Enclosed is a report of forest insect detection surveys completed during the 1950 season through the cooperative efforts of a region-wide group of public and private foresters and entomologists.

This report is intended primarily for control planning purposes, hence only those insects against which control may be undertaken in 1951 are covered. A more comprehensive and detailed report covering other forest insects will be issued later in the year.

Of primary interest to Oregon and Washington timberland owners and managers will be the present status of the spruce budworm infestation. The 1950 survey revealed a current budworm infestation in Oregon and Washington of 2,036,000 acres, as against 2,276,000 acres in 1949.

During June and July, 1950, successful control projects were conducted on 934,000 acres. The reduction in the total infested acreage gained through these projects was largely offset by the development of new infestation centers. However, the 1950 control efforts were confined primarily to areas of heavy infestation in which extensive timber killing was in progress, and the marked reduction of the acreages within this category in 1950 demonstrates the real success of the 1950 control program.

The contents of this report will be discussed at the forest insect control meeting called at Portland, Oregon, on October 13 by Mr. E. L. Kolbe, Chairman of the Spruce Budworm Action Committee. It is hoped that you can attend this meeting and take part in the discussion of the future control program. Please bring your copy of the report to the meeting with you.

BUREAU OF
Entomology and Plant Quarantine
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Forest Insect Laboratory,
BERKELEY, CALIF.

Sincerely yours,

R. L. Furniss

R. L. Furniss
Entomologist

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REPORT OF FOREST INSECT DETECTION SURVEYS IN OREGON AND WASHINGTON

SEASON OF 1950

INTRODUCTION

The current widespread epidemic of the spruce budworm continues as a major threat to the forests of Oregon and Washington. Control efforts during the past two years have unquestionably prevented extensive timber killing, but vast areas of infestation remain, and the continuation of a vigorous control program is still urgently needed.

Surveys made during the years 1947 to 1949 1/2/3/ showed the budworm outbreak to be developing rapidly, both in size and intensity. The 1949 survey, a joint undertaking by the federal government, the States of Oregon and Washington, and the timber owners, was the first all-inclusive forest insect survey of these two states. This survey, conducted by aerial and ground methods, showed epidemic infestation on 2,276,000 acres.

The first effort to control the outbreak was a program conducted during May and June of 1949 by the U. S. Forest Service and the Oregon State Board of Forestry. This program included the treatment of 106,000 acres on the Mt. Hood National Forest, and 161,000 acres in the vicinity of Eugene, Oregon. While satisfactory control was obtained in the areas treated, the results of the 1949 survey pointed to the need for a greatly expanded and accelerated control program.

Accordingly, during June and July 1950, 933,700 acres were treated. Areas of heavy infestation in all epidemic centers were included in this program, and control results were uniformly excellent.

1/ Buckhorn, W. J. - Defoliator Situation in the Fir Stands of Eastern Oregon and Washington, Season of 1947. Office Report February 18, 1948.

2/ Furniss, R. L., Buckhorn, W. J., and Wright, K. H. - The Spruce Budworm in Oregon and Washington, Season of 1948. Office Report November 1, 1948.

3/ Lindsten, A, Buckhorn, W. J., Wear, J. F., Whiteside, J. M., and Wright, K. H. - Spruce Budworm Situation in Oregon and Washington - 1949 Season. Mimeographed Report September 1, 1949.

During the summer of 1950, another comprehensive survey was conducted. The survey techniques used in 1949 were employed, and once again public and private agencies and individuals generously participated. (See acknowledgement and tables 7 - 11 in Appendix.)

In the report which follows the results of the 1950 survey are tabulated and analyzed to provide a basis for further control planning. General statements are also made regarding the status of the principal insects, other than the budworm, now active in Oregon and Washington. In a later report, not concerned with control planning, the detailed findings of the survey will be reported for all major forest insects of the region.

PART I - SPRUCE BUDWORM SITUATION

General Statement

The region-wide status of the budworm epidemic is presented by areas according to degrees of infestation in table 1, which follows. In Table 2 the budworm infestation data are presented by areas according to forest ownership. The infestation map in the Appendix shows the location and extent of the infested areas. Graph 1 shows the over-all progress of infestation during the course of the outbreak from 1944 to 1950. The trends of infestation since 1947 are illustrated by localities in Graph 2.

As a result of the intensive control program during the past two seasons, the budworm situation is materially improved. (See Graph 1.) The over-all epidemic infestation has been reduced from 2,276,000 acres in 1949 to 2,036,000 acres in 1950. Important progress has been made in reducing the area of heavy infestation from 887,000 acres in 1949 to 185,000 acres in 1950. No new areas of killed timber developed in 1950 as compared with 9,000 acres in 1949. Thus the control program is having a marked effect upon the outbreak despite a strong tendency of the budworm to increase on areas not yet treated.

The most extensive areas of infestation are in the Blue Mountains where the budworm is still epidemic on 1,810,080 acres. In western Oregon epidemic infestation persists to the extent of 96,405 acres. In the Eastern Oregon Cascades there are 104,460 acres of epidemic infestation that show strong signs of increasing. In the Eastern Washington Cascades new centers of infestation totaling 25,440 acres developed in 1950. In addition to the epidemic areas of infestation, there are extensive areas in both Oregon and Washington where the budworm is present in small numbers.

In the following discussion of the budworm situation by areas and in the tables, the classification of the degree of infestation is essentially the same as that used in the 1949 survey report. Only the areas of epidemic infestation, those that could be detected from the air, are included in the tabulations. The "dead" category is not represented in the data for 1950. Definitions of the five recognized degrees of infestation follow:

Light -Defoliation light, barely visible from the air; no tree killing expected for at least two years.
Moderate - Defoliation moderate; no tree killing expected for at least one year.
Heavy - Defoliation moderate to severe; some tree killing in progress; general tree killing probably next year.
Very Heavy - Defoliation severe; general tree killing in progress.
Dead - Defoliation complete; trees predominantly dead on extensive areas.

Blue Mountains

As indicated in table 1, the Blue Mountains subregion is still the principal area of budworm infestation.

In the 1950 spraying program approximately 775, 000 acres were treated in this subregion, and the resultant mortality ranged from 98.6 per cent to 99.7 per cent on the individual control units. Nevertheless, 1,810,080 acres of light to heavy infestation remain. Furthermore, while no organized ground sampling outside the visible areas of defoliation was conducted in 1950, general observations indicated that the spruce budworm is present in practically all fir and spruce stands in the Blue Mountains. On the unsprayed areas the over-all trend of infestation was upward, although some local areas showed decreases due to natural factors. The pattern of timberland ownership of the infested areas remains essentially the same as in 1949 with 65.6 per cent federal and 34.4 per cent state, private, and other.

Umatilla National Forest - The budworm situation on the Umatilla National Forest and adjoining areas is still highly critical. Through the successful spraying of over 625,000 acres on this area during the 1950 control project, the acreage in the heavy to dead classifications has been reduced from 610,720 to 103,520. However, the total infested acreage remains very large. Ownership of the 857,000 acres now infested is 62.2 per cent federal and 37.8 per cent state, private, and other. Of the total infested acreage, 561,920 acres are in Oregon, and 295,000 acres are in Washington.

The areas of heavy infestation detected in the Umatilla National Forest area are centered in the following localities:

1. Upper Rhea, Willow, and Johnson Creek drainages
2. Jarbeau and Fry Meadows
3. Touchet and Tucannon River drainages
4. Kinzua watershed
5. Meacham Summit area
6. Camas and Owing Creek drainages
7. Anatone-Big Butte areas

While the above centers of infestations are the most critical in the Umatilla National Forest area and unquestionably require treatment, they are widely scattered and interspersed with areas of moderate to light infestation - all of which are adjacent to or near 1950 control areas. It is recommended, therefore, that the entire remaining infestation in this area be treated as soon as possible.

Wallowa National Forest - Spruce budworm infestations on and adjacent to the Wallowa National Forest are second in extent only to those of the Umatilla National Forest. At present the total infested area is 473,760 acres, of which 36,160 acres are heavily infested. The total area is practically the same as in 1949, but the heavily infested area has been reduced by 107,550 acres. Ownership is 65.5 per cent federal and 34.5 per cent state, private, and other.

TABLE 1. SUMMARY OF SPRUCE BUDWORM SITUATION BY INTENSITY OF INFESTATION - 1950 1/

LOCALITY	INTENSITY OF INFESTATION									
	Light		Moderate		Heavy		Very Heavy		Total	
	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
BLUE MOUNTAINS										
Umatilla N.F.	416,800	48.6	337,120	39.3	103,520	12.1			857,440	100
Wallowa N.F.	168,160	35.5	269,440	56.9	36,160	7.6			473,760	100
Whitman N.F.	98,720	46.6	106,240	50.2	6,720	3.2			211,680	100
Malheur N.F.	30,500	19.3	123,420	77.9	4,480	2.8			158,400	100
Ochoco N.F.	56,320	64.1	17,920	20.4	13,600	15.5			87,840	100
Umatilla Indian Res.	20,960	100.0							20,960	100
Subtotal	791,460	43.7	854,140	47.2	164,480	9.1			1,810,080	100
EASTERN OREGON CASCADES										
Deschutes N.F.	20,440	35.4	31,420	54.4	4,720	8.2	1,200	2.0	57,780	100
Mt. Hood N.F.	2,200	11.9	15,725	85.1	560	3.0			18,485	100
Warm Springs Indian Res.	18,195	64.5	8,080	28.7	1,920	6.8			28,195	100
Subtotal	40,835	39.1	55,225	52.9	7,200	6.9	1,200	1.1	104,460	100
WESTERN OREGON										
Southwest Oregon			1,895	100.0					1,895	100
Clackamas River			1,020	33.1	2,065	66.9			3,085	100
McKenzie Bridge	34,695	46.4	32,980	44.2	7,040	9.4			74,715	100
N.Fork Willamette River	3,065	35.0	2,425	27.7	3,260	37.3			8,750	100
S.Fork McKenzie River			7,960	100.0					7,960	100
Subtotal	37,760	39.2	46,280	48.0	12,365	12.8			96,405	100
EASTERN WASHINGTON CASCADES										
Chelan N.F.	16,800	100.0							16,800	100
Wenatchee N.F.			8,640	100.0					8,640	100
Subtotal	16,800	66.0	8,640	34.0					25,440	100
TOTAL	886,855	43.5	964,285	47.4	184,045	9.0	1,200	0.1	2,036,385	100

1/ Does not include 933,700 acres sprayed in spring of 1950.

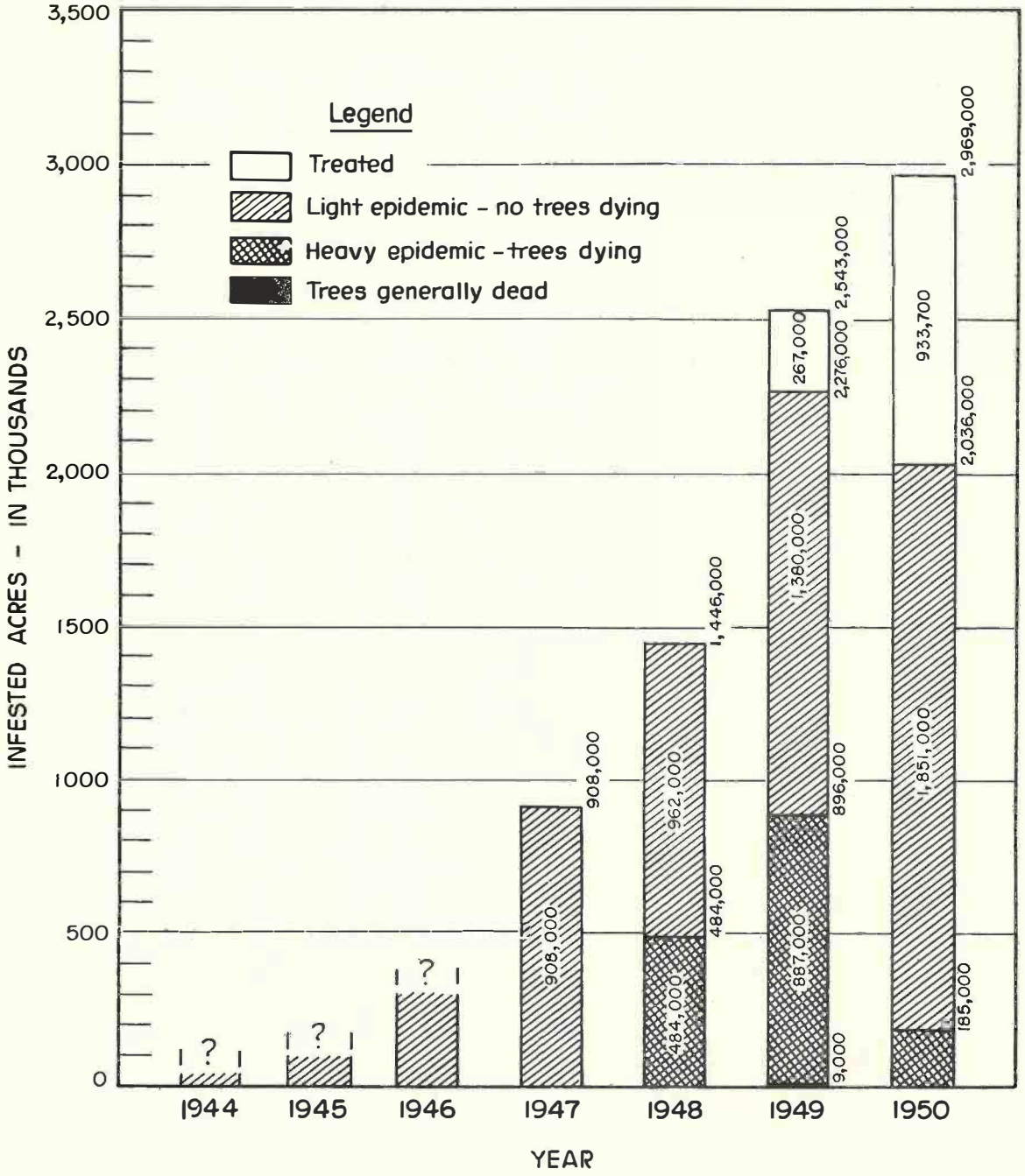
TABLE 2. SUMMARY OF SPRUCE BUDWORM SITUATION BY OWNERSHIP CLASSES - 1950 1/

LOCALITY	OWNERSHIP							
	Forest Service		Indian Service		State, Private & Other		Total	
	Acres	%	Acres	%	Acres	%	Acres	%
BLUE MOUNTAINS								
Umatilla N.F.	532,960	62.2			324,480	37.8	857,440	100
Wallowa N.F.	310,240	65.5			163,520	34.5	473,760	100
Whitman N.F.	163,840	77.4			47,840	22.6	211,680	100
Malheur N.F.	102,240	64.5			56,160	35.5	158,400	100
Ochoco N.F.	56,160	63.9			31,680	36.1	87,840	100
Umatilla Indian Res.			20,960	100.0			20,960	100
Subtotal	1,165,440	64.4	20,960	1.2	623,680	34.4	1,810,080	100
EASTERN OREGON CASCADES								
Deschutes N.F.	52,000	90.0			5,780	10.0	57,780	100
Mt. Hood	15,235	82.4			3,250	17.6	18,485	100
Warm Springs Indian Res.			28,195	100.0			28,195	100
Subtotal	67,235	64.4	28,195	27.0	9,030	8.6	104,460	100
WESTERN OREGON								
Southwest Oregon					1,895	100.0	1,895	100
Clackamas River	3,085	100.0					3,085	100
McKenzie Bridge	69,595	93.1			5,120	6.9	74,715	100
N.Fork Willamette River	8,750	100.0					8,750	100
S.Fork McKenzie River	7,960	100.0					7,960	100
Subtotal	89,390	92.7			7,015	7.3	96,405	100
EASTERN WASHINGTON CASCADES								
Chelan N.F.	15,520	92.4			1,280	7.6	16,800	100
Wenatchee N.F.	3,360	38.9			5,280	61.1	8,640	
Subtotal	18,880	74.2			6,560	25.8	25,440	100
TOTAL	1,340,945	65.9	49,155	2.4	646,285	31.7	2,036,385	100

1/ Does not include 933,700 acres sprayed in spring of 1950.

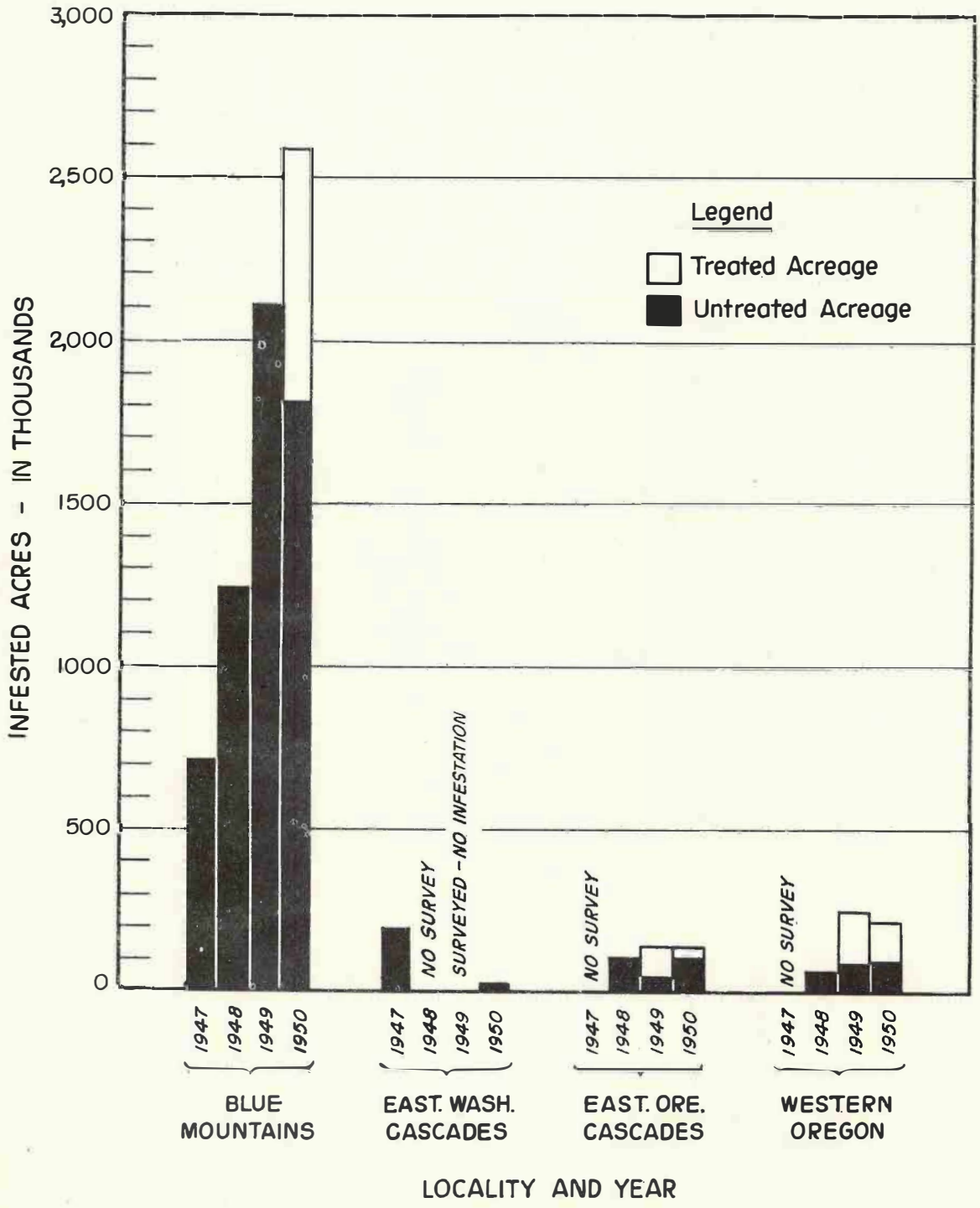
Graph I

PROGRESS OF SPRUCE BUDWORM EPIDEMIC
IN OREGON AND WASHINGTON



Graph 2

TRENDS OF SPRUCE BUDWORM EPIDEMIC BY LOCALITIES FOR THE PERIOD 1947-1950



During the 1950 control project, 55,583 acres of heavily defoliated timber were sprayed on the Joseph and Day Ridge Control Units. An average mortality of 99.5 per cent on the Joseph Unit and 99.4 per cent on the Day Ridge Unit was obtained.

The 1950 infestation by the budworm on the Wallowa differed considerably from that of 1949. On the Snake-Imnaha area and the eastern portion of the Chesnimnus area the infestation declined both in extent and intensity. On the western portions of the Wallowa the situation did not improve. Between Bear Creek and the Minam River and also in the vicinity of Kirkland Lookout heavy defoliation continued. Centers of light to moderate infestation in the Grossman and Mud Creek drainages expanded considerably.

Control on the Wallawa needs to be considered from the standpoint of the protection of the areas already sprayed and the prevention of losses on areas now heavily infested.

Whitman National Forest - The total area of epidemic infestation by the budworm on and adjacent to the Whitman is 211,680 acres, of which 6,720 acres are heavily infested. As a result of the spraying program of 1950 the gross area of infestation has been reduced by 38 per cent, and the heavy and very heavy infestation represent only 3.2 per cent of the 1950 total as against 30.1 in 1949. Ownership of the currently infested area is 77.4 per cent federal and 22.6 per cent state, private, and other.

In 1950 some 92,692 acres were sprayed on the Whitman area including 71,912 acres in the La Grande control unit and 20,780 acres in the Starkey control unit. The average kill of the budworm in both these units was 99.5 per cent.

In the Clark, Five Point, and Indian Creek drainages, centers of heavy infestation developed in 1950. While no tree mortality occurred in these drainages in 1950, another season of defoliation will undoubtedly cause considerable loss of timber. Another center of infestation that is building up rapidly and will bear close watching is in the vicinity of Glass Mountain.

Control on the Whitman should be considered in the same light as the Wallowa; that is, the area adjoining the sprayed areas and the heavily infested areas should be given first consideration.

Malheur National Forest - The trend of spruce budworm infestation on and adjacent to the Malheur National Forest has been steadily upward since 1947. A total of 158,400 acres are now infested, of which 4,480 acres are heavily infested. These figures compare with a total of 127,900 acres of moderate infestation in 1949. Ownership of the currently infested timberlands is 64.5 per cent federal and 35.5 per cent state, private, and other.

As yet no effort has been made to control the budworm outbreak in the Malheur area.

The increased area of infestation in 1950 is largely an extension of the 1949 epidemic into the fir stands near the head of Long Creek. Most of the defoliation on the newly infested area is light. The infestation on the remaining areas is preponderantly moderate with a small acreage of heavy infestation in draws and canyons. To date little tree killing has occurred, and in all probability the affected stands will survive another season's defoliation without appreciable mortality.

On a priority basis the Malheur area should rank well down the list in plans for control in 1951.

Ochoco National Forest - Epidemic infestation of the budworm on and adjacent to the Ochoco now totals 87,840 acres, of which 13,600 acres are heavily infested. Ownership of the infested area is 63.9 per cent federal and 36.1 per cent state, private, and other.

The course of the budworm infestation on the Ochoco area has been variable. In 1948 an outbreak of 15,000 acres that had been developing for several years on the Snow Mountain District subsided with little or no loss of timber. In 1949 two new epidemic centers developed, one near Ochoco Summit, and the other near Waterman, north of the national forest boundary. Both of these centers increased in size in 1950.

Defoliation on the Ochoco Summit area is predominately light with the remainder moderate. In contrast, much of the defoliation on the Waterman area is heavy, especially in the draws and canyons. While no appreciable tree mortality has occurred on either of these areas, one more year of heavy defoliation on the Waterman area probably will cause extensive killing.

Although no spraying operations have been necessary to date on the Ochoco, the 24,000 acre infestation on the Waterman area has now reached the point where control measures must be seriously considered.

Umatilla Indian Reservation - A total of 20,960 acres of light infestation by the budworm is present on the Umatilla Indian Reservation. In 1949 the total infested area was 7,780 acres including 1,710 acres of heavy infestation. The heavy infestation, all of which was in the northeastern part of the reservation, was eliminated by the control program in 1950. The untreated areas of light infestation in the southeastern part of the reservation continued to expand.

From a control standpoint the budworm outbreak on the Umatilla Indian Reservation is part of the much larger control problem on the adjoining Umatilla National Forest. These two areas should be considered jointly in planning control operations for 1951.

Eastern Oregon Cascades

Epidemic infestation of the spruce budworm in the Eastern Oregon Cascades is confined to the Deschutes and Mt. Hood National Forests and the Warm Springs Indian Reservation. In 1948, when presence of the budworm was first noted in this region, the total area of infestation was 102,790 acres. Through control in 1949, the outbreak was cut down to 39,990 acres. Despite continued control in 1950 the total infested area increased to 104,460 acres, of which 8,400 acres are classified as being heavily to very heavily defoliated. Ownership of the currently infested area is 91.4 per cent federal and 8.6 per cent state, private, and other.

The intensive ground survey revealed that the budworm is widely active in this region. Of a total of 233 check plots, 108 showed the budworm to be present. The prevalence of the budworm, plus its tendency toward rapid increase, makes the problem of control in the Eastern Oregon Cascades a difficult one. Despite these difficulties, the timber values that are threatened make it essential to continue the control program already well under way.

Deschutes National Forest - The 1950 survey revealed a total of 57,780 acres of epidemic infestation on the Deschutes as compared with only 7,000 acres in 1949. While the attacks are primarily confined to reproduction and second-growth fir, the epidemic shows strongly aggressive tendencies. There are 5,920 acres of heavy to very heavy defoliation. Ownership of the currently infested area is 90.0 per cent federal and 10.0 per cent state, private, and other.

Control was initiated in 1950 through the spraying of 4,880 acres. Although a kill of approximately 100 per cent was obtained on the sprayed area, the outbreak continued to develop on the surrounding areas. Because of the size and aggressiveness of this epidemic and its proximity to extensive stands of high value fir, control through aerial spraying in 1951 must be seriously considered.

Mt. Hood National Forest - Two centers of epidemic infestation were disclosed in the Mt. Hood National Forest by the 1950 aerial survey. These areas, which border and to some extent overlap the control area of 1949, comprise 11,573 acres in Mill Creek and 6,910 acres in the Jordan Creek Drainages.

The only heavy defoliation observed was on a 560-acre portion of the Mill Creek infestation. Ownership of the epidemic area is 82.4 per cent federal and 17.6 per cent private, state, and other.

Because of the threat to watersheds and to high value timber stands immediately west of this infestation, its control should be given serious consideration.

Warm Springs Indian Reservation - Within the boundaries of the Warm Springs Indian Reservation, two areas of epidemic infestation totaling 28,195 acres were recorded during the 1950 survey. On the Badger Butte area, which joins the southwestern part of the block sprayed in 1950, there are 16,300 acres of infestation, 1,920 acres of which are heavily infested. The Whitewater River infestation, which is adjacent to the epidemic area on the Deschutes National Forest, comprises 11,895 acres of light to moderate infestation.

The two infested areas on the Warm Springs Indian Reservation should be considered as integral parts of any control work undertaken on the adjoining Deschutes and Mt. Hood National Forest areas.

Western Oregon

Since 1948, when the first recorded outbreak of the spruce budworm in western Oregon was found, a continuing effort has been made to suppress all centers of infestation. Because of the very high timber values involved this area has been given first priority in the control program. Extensive spraying projects were conducted in 1949 and 1950.

To date 286,730 acres have been successfully treated in western Oregon. The acreage of heavy and very heavy infestation has been reduced from 16,160 acres in 1949 to 12,365 acres in 1950. New outbreaks have developed, however, and the total epidemic acreage of 96,405 acres recorded in 1950 represents a net increase of 7,765 acres in the past year.

The ownership of the currently infested area is 92.7 per cent federal and 7.3 per cent state, private and other.

The intensive ground surveys conducted in 1949 and 1950 have shown that the spruce budworm is present in varying degrees practically everywhere in western Oregon. These ground surveys indicated that the forests around Cascadia, Wendling, Leaburg, Lowell, and Cottage Grove should be carefully watched for the possible development of future epidemics.

Southwest Oregon Area - The 1950 survey revealed an epidemic infestation of 1,895 acres in the vicinity of Roseburg. This area is probably a remnant of the 1949 Roseburg infestation of which 23,661 acres were successfully treated in 1950.

The current infestation is located in the drainage of the North Umpqua River and is of moderate intensity. Ownership is 100 per cent state, private, or other.

The infested timber is of the poor-quality, foothill type, but adjacent valuable Douglas-fir stands are threatened; hence, this small outbreak should be controlled in 1951.

Clackamas River Area - In the vicinity of Sisi Butte, near the headwaters of the Clackamas River, a new and potentially serious spruce budworm infestation of 3,085 acres was detected in 1950. Of the total epidemic area, 1,020 acres have been classified as moderate and 2,065 acres as heavy. Ownership is 100 per cent federal.

While the infestation is small, timber and watershed of high value are threatened; accordingly control measures should be undertaken in 1951.

McKenzie Bridge Area - The 1950 survey revealed 14,715 acres of epidemic infestation in the McKenzie Bridge vicinity. The infested area, containing principally mature and second-growth Douglas-fir, extends to the alpine fir stands at high elevations. Included are the stands along the McKenzie Pass highway, as well as the Deer Creek drainage immediately adjacent to the Blue River Experimental Forest. Some 7,040 acres are heavily infested, with the balance of the acreage approximately evenly divided between light and moderate intensities. Ownership is 93.1 percent federal and 6.9 percent private, state, and other.

During the 1950 control program approximately 40,000 acres were sprayed in the McKenzie Bridge area, which resulted in an average budworm mortality of 98.0 per cent. The present infestation almost completely surrounds the area treated in 1950.

The possibility of reinfestation of the control unit and the continuing threat to commercial timber, watersheds and recreational areas should be ample justification for treatment in 1951.

North Fork Willamette River Area - Adjoining the southern boundary of the 1949 control unit on the North Fork of the Willamette River area, 8,750 acres of new infestation were disclosed by the 1950 survey. Some 3,260 acres of the new epidemic are heavy, 2,425 acreas are moderate, and 3,065 acres are light in intensity. Ownership is 100 per cent federal.

For the same reasons as given for the McKenzie Bridge area, this infestation should be treated in 1951.

South Fork McKenzie River Area - The 1950 aerial survey revealed a 7,960-acre budworm infestation in the Augusta Creek drainage of the South Fork of the McKenzie River. This infestation was rated as being of moderate intensity. The ownership is 100 per cent federal. The large volume second-growth stands involved are so near the McKenzie Bridge and North Fork Willamette areas that they would necessarily be included in any spray program undertaken for these areas.

Eastern Washington

Since 1929, when several small centers of spruce budworm infestation were noted at Northport, Washington, epidemics of the insect have occurred sporadically in eastern Washington and have varied from small isolated spot infestations to outbreaks of major proportions. No epidemic infestations were observed in the 1949 aerial survey of this area, but ground survey crews found evidence of budworm population on more than half the plots examined.

The 1950 aerial survey of eastern Washington revealed that the budworm population had increased to epidemic proportions on 25,440 acres on the Chelan and Wenatchee National Forests. The 1950 epidemic is of light to moderate intensity. Ownership is 74.2 per cent federal and 25.8 per cent private, state and other.

In the 1950 ground survey light infestations were recorded for the first time in Klickitat County and in the eastern portions of the Gifford Pinchot National Forest. Light infestations were also noted on the Yakima Indian Reservation, and a light infestation is known to exist on the Colville Indian Reservation, although no budworms were found on the plots examined.

Chelan National Forest - The epidemic infestation detected in the course of the aerial survey of the Chelan National Forest consists of two centers of infestation totaling 16,800 acres in the First Creek and Twentymile Creek drainages. The ownership of the infested area is 92.4 per cent federal and 7.6 per cent private, state and other.

Much of the merchantable timber has already been removed from these drainages and, although the spruce budworm is working in combination with a sawfly and the black-headed budworm in this area, little or no loss of timber is expected in 1951. Immediate control measures should not be necessary in the Chelan National Forest.

Wenatchee National Forest - Through the 1950 aerial survey, a spruce budworm epidemic of moderate intensity was found in the upper Icicle Creek drainage on the Wenatchee National Forest. The ownership of the infested area is 38.9 per cent federal, and 61.1 per cent private, state and other.

This infestation is in stands of merchantable quality, and although control in 1951 may not be necessary, close attention should be given to this area in subsequent surveys.

Western Washington

Aerial surveys of all timbered areas of western Washington revealed no epidemic infestations of the spruce budworm in either 1949 or 1950. However, ground surveys each year have shown that the budworm is present in very light infestations over much of the area between U.S. Highway 99 and the Cascade Divide. Local spots of very light infestation have been found from the Columbia River northward nearly to the Canadian border. The most important of these local areas are in the drainages of the Cowlitz, Deschutes, Duwamish, Kalama, Lewis, and Nisqually Rivers.

The spruce budworm situation in western Washington has not reached the epidemic stage. However, the tremendous timber values within this area warrant very close and continuous observations, and the immediate application of control measures in case any outbreak should develop.

Recommendations

In the 1950 control program nearly 1,000,000 acres were treated and highly satisfactory results were achieved. While this was an enormous undertaking, efficient administration was possible. Supplies, equipment, and services were obtained in time and in the amounts necessary to complete the scheduled program.

It is recommended, therefore, that a program of similar size be considered for the 1951 season. A program of approximately 1,000,000 acres would be administratively practical, and would provide reasonable progress toward complete control of the budworm epidemic in the near future.

Since such a program would cover only about half the total infested acreage, it will be necessary to establish priorities as a basis for the selection of areas to be treated in 1951. It is recommended that areas in the following classifications be given first priority:

1. Infested areas near or adjacent to control areas of 1949 and 1950 which, if left uncontrolled, might reinfest the controlled areas.

2. Areas of new infestation in western Oregon and in the eastern Oregon Cascades which might serve as centers of further spread in these localities.

3. Areas in the Blue Mountains region which are heavily infested and in which tree killing is imminent or in progress.

PART 2 - OTHER INSECT PROBLEMS

The survey of 1950 provided data on the status of the principal forest insects of Oregon and Washington. Data on the activities of numerous species were taken, but only those insects against which control might possibly be undertaken in 1951 are discussed in this report. The other species will be discussed in a more detailed report to be issued later.

Mountain Pine Beetle

An aggressive epidemic of the mountain pine beetle in lodgepole pine southwest of Bend, Oregon, on the Wanoga Butte area of the Deschutes National Forest has been in progress for several years. While this outbreak is now confined to an area of about 20,000 acres, it is a real threat to the entire 1,232,500 acres 4/ of lodgepole-pine type in Deschutes, Klamath and Lake Counties, Oregon.

A 10 per cent survey of the infested area in September 1950 revealed an average of 2.1 currently infested trees per acre or approximately 42,000 trees for the entire area. The estimated infestation in 1949 was 1.23 trees per acre or 24,600 trees in all. Thus, despite some winter killing of the 1949-50 brood, the outbreak continued to develop in 1950. Obviously this is a virulent outbreak that is very likely to spread extensively in the lodgepole pine stands of the Deschutes Basin.

If the timber values involved in the threatened spread of this outbreak are sufficient to warrant control, it is important that control be applied soon; otherwise the problem will largely be one of salvage rather than control.

The mountain pine beetle continues to be locally epidemic in many white pine and lodgepole pine stands in the Cascade Range of Oregon and Washington. Since the affected stands are predominantly unmerchantable, direct control is not justified. Outbreaks in noncommercial stands of lodgepole pine and stagnated second-growth ponderosa pine are also present in the Blue Mountains.

4/ Data taken from U.S.D.A. Miscellaneous Publication 490, Forest resources of the ponderosa pine region of Washington and Oregon.

Western Pine Beetle

The regional importance of this beetle is such that it is desirable to point out that the current status of infestation is uniformly low. Selective logging methods, now widely practiced, and a series of years of good growing conditions have combined to keep the western pine beetle in check. No direct control measures are needed in 1951.

Fir Engraver Beetles

Fir engraver beetles are causing extensive damage to stands of silver fir in Whatcom, Skagit, and Snohomish Counties, Washington. Approximately 100 centers of epidemic infestation were located during the surveys of 1949 and 1950. So far no measures for the control of these insects have been developed. The best that can be recommended is to suggest that salvage logging operations be directed into the critically infested stands to utilize the dead timber and possibly prevent spread of the beetles to other areas.

Hemlock Looper

The survey of 1949 showed several small areas of hemlock looper infestation in Clallam County, Washington. These areas totaled some 400 acres. In 1950 the infestation spread around these centers to embrace approximately 5000 acres. While the outbreak has not reached serious proportions, and there were some signs of a material decline in 1950, further detailed investigations are planned to determine whether control measures should be applied in the spring of 1951.

APPENDIX

Acknowledgements

This report is the product of much cooperative effort. The Bureau of Entomology and Plant Quarantine and the Oregon State Board of Forestry took the lead in coordinating the survey program and reporting the results. Mr. John M. Whiteside headed the program for the Bureau, and Mr. Alvin Lindsten acted in the same capacity for the State of Oregon. Mr. William D. Hagenstein, forest engineer of the Forest Conservation Committee of Pacific Northwest Forest Industries, and Mr. E. L. Kolbe, chief forester of the Western Pine Association, were very helpful in enlisting wide participation by industrial foresters. The many individuals and organizations that took part in the detailed ground sampling for the spruce budworm are listed in tables 7-11.

The aerial phase of the survey was a two-way undertaking by the Bureau of Entomology and Plant Quarantine and the Oregon State Board of Forestry. The State surveyed all of Oregon except the Blue Mountains. The Bureau surveyed the Blue Mountains and all of Washington. For the State, Mr. A. Larson was pilot, and Messrs. A. Gruba and A. Lindsten were observers and mappers. For the Bureau, Mr. J. F. Wear was pilot and Messrs. W. J. Buckhorn, A. T. Davison, W. K. Coulter, and K. H. Wright were observers and mappers.

The ground checking of the aerial survey was done primarily by Messrs. J. M. Whiteside, W. J. Buckhorn, A. T. Davison, J. F. Wear, W. K. Coulter, and K. H. Wright for the Bureau, and A. Lindsten and A. Gruba for the State.

TABLE 3. COMPARISON OF 1949 AND 1950 SPRUCE BUDWORM AERIAL SURVEYS

SUBREGION		Timbered Acres Covered	Air Miles Flown	Mapping Hours	Ferry Hours	Total Hours	Cost per Area
Blue Mountains	1949	6,963,975	3,460	27.8	8.6	36.4	$247.62
	1950	6,193,329	3,750	20.7	2.0	22.7	227.00
Eastern Oregon Cascades	1949	6,590,480	2,720	21.8	6.8	28.6	194.53
	1950	*6,590,480	3,710	30.0	5.3	35.3	412.48
Western Oregon	1949	15,670,425	7,580	61.5	3.9	65.4	866.97
	1950	*15,670,425	8,340	71.3	8.1	79.4	981.05
Eastern Washington Cascades	1949	8,001,109	3,180	24.9	3.5	28.4	317.92
	1950	8,001,109	3,350	17.3	3.0	20.3	203.00
Western Washington Cascades	1949	8,063,685	2,960	22.1	5.6	27.7	273.99
	1950	8,063,685	4,000	22.7	1.5	24.2	242.00
Western Washington	1949	3,710,326	2,375	14.3	1.5	15.8	158.00
	1950	3,710,326	3,430	20.1	1.2	21.3	213.00
TOTALS	1949	49,000,000	22,275	172.4	29.9	202.3	$2,059.03
	1950	48,229,354	26,580	182.1	21.1	203.2	$2,278.53

*Includes acreage sprayed in 1950 control project.

TABLE 4. SUMMARY OF AERIAL SURVEY OPERATIONAL RECORD 1950

AIRCRAFT	Horsepower	Cruising MPH	Flying Time	Rental and Operational Cost
Cessna 195 (9367A)	300	160	88.5	$885.00
Stinson Station Wagon (6077M)	165	105	114.7	1,393.53
			203.2 hr.	$2,278.53

TABLE 5. SUMMARY OF SPRUCE BUDWORM GROUND SURVEY CHECK PLOTS - 1950

SUBREGION	Number of Man Days	Number of Check Plots: Budworm Present	%	Budworm Absent	%	Total	%
Western Oregon	257	325	16.4	1,652	83.6	1,977	100
Eastern Oregon	40	108	46.4	125	53.6	233	100
Western Washington	196	37	2.3	1,549	97.7	1,586	100
Eastern Washington	56	70	24.4	217	75.6	287	100
Totals	549	540	13.2	3,543	86.8	4,083	100

TABLE 6. COMPARISON BETWEEN THE 1949 AND 1950 SPRUCE BUDWORM GROUND SURVEY

SUBREGION	Year	Number of Check Plots: Budworm Present	%	Budworm Absent	%	Total	%
Blue Mountains	1949*	116	73.9	41	26.1	157	100
	1950	No ground survey conducted					
Eastern Oregon Cascades	1949	73	38.6	116	61.4	189	100
	1950	108	46.4	125	53.6	233	100
Western Oregon	1949	341	18.0	1,557	82.0	1,898	100
	1950	325	16.4	1,652	83.6	1,977	100
Western Washington	1949	31	2.6	1,141	97.4	1,172	100
	1950	37	2.3	1,549	97.7	1,586	100
Eastern Washington	1949	111	50.9	107	49.1	218	100
	1950	70	24.4	217	75.6	287	100
Totals	1949	672	18.5	2,962	81.5	3,634	100
	1950	540	13.2	3,543	86.8	4,083	100

*Ground survey conducted in areas not previously recorded as being infested.

TABLE 7. RESULTS OF COOPERATIVE SPRUCE BUDWORM GROUND SURVEY IN WESTERN OREGON - 1950

Area	Agency	Observer(s)	Examination Symbol	Examination Dates	No. Man Days	No. of Check Plots: Budworm Present	No. of Check Plots: Budworm Absent	No. of Check Plots: Total
Benton County	O.S.B.F.*	Kaiser,H. Kangaur,R.	AP	8/22-8/25	4	4	35	39
	Pope & Talbot, Inc.	Kincaid,F.	S	6/29	1		1	1
Clackamas County	Crown Zellerbach Corp.	Clark,K. Harrington,G.	D	7/11	2		36	36
	O.S.B.F.	Brockman,C. Popham,T.	AO	8/3	2	1	21	22
	Weyerhaeuser Timber Co.	Ferguson,B.	O	6/29-6/30	2	1	19	20
		Kummer,R.	Q	6/29-6/30	2	1	13	14
		Riddagh,D.	P	6/29	1		14	14
Clatsop County	Crown Zellerbach Corp.	Mozar & Reynolds	H	7/6	2		16	16
		Harris & Wycoff	I	7/6	2		12	12
	Longview Fiber Co.	Freed,W.	AA	7/6	1		3	3
	O.S.B.F.	Brockman,C. Popham,T.	AO	8/2	2		8	8
		Randall,W.	AD	7/14-7/17	2	1	14	15
	St. Helens Pulp & Paper Co.	McDaniels,E.	AM	7/10-7/12	3		19	19
Columbia County	Crown Zellerbach Corp.	Collard,C.	F	7/6-7/7	2		46	46
		Lindsay,R.	G	6/21-7/6	5	1	43	44
		Pugsley,L.	E	7/6-7/10	2	5	36	41
	Longview Fiber Co.	Loeb, J.	AB	6/28-7/3	3		24	24
Coos County	Bureau of Land Management	Brackenbush,A. Peterson,E. Smith,G.	R	6/29-7/11	3		13	13
	Coos Bay Lumber Co.	Ruhmann,W.	AN	8/19	1		18	18
	Irwin-Lyons Lbr.Co.Inc.	Fisher,D.	AE	6/27-7/2	3		32	32
	O.S.B.F.	Brockman,C. Popham,T.	AO	8/8-8/10	6	5	69	74
	Weyerhaeuser Timber Co.	Cornelius,R. Henderson,H. Higgenbotham,D. Sommer,H.	AF	6/26-7/14	8	6	69	75
Curry County	Coos Bay Lumber Co.	Ruhmann,W.	AN	8/19	1		18	18

*Oregon State Board of Forestry

(continued)

TABLE 7 (Continued)

Area	Agency	Observer(s)	Symbol	Examination Dates	No. Man Days	No. of Check Plots: Budworm Present	Budworm Absent	Total
Douglas County	Gardiner Lbr.Co.	Read,W.	AR	7/12-7/16	4	1	32	33
	O.S.B.F.	Kaiser,H. Kangaur,R.	AP	8/7-8/14	12	2	91	93
	Weyerhaeuser Timber Co.	Price,C.	AK	6/30	1		6	6
		Watson,R.	AJ	7/5	1		9	9
		Cornelius,R. Henderson,H. Higgenbotham,D. Sommer,H.	AF	6/26-7/14	8	1	65	66
Jackson County	O.S.B.F.	Brockman,C. Popham,T.	AO	8/14-8/17	4	4	25	29
		Kaiser,H. Kangaur,R.	AP	8/15-8/16	4	9	8	17
Josephine County	O.S.B.F.	Brockman,C. Popham,T.	AO	8/14-8/17	4	2	31	33
		Kaiser,H. Kangaur,R.	AP	8/17	2		16	16
Lane County	Booth-Kelly Lbr.Co.	Sandoz,F.	J	6/23-7/8	9	71	16	87
	Bureau of Land Management	Bowers,J.	U	7/7-7/11	3	1	14	15
		Watts,J.	T	7/7-7/12	3	3	14	17
	Long-Bell Lbr. Co.	Foster,C.	L	7/6-7/10	3		39	39
	O.S.B.F.	Brockman,C. Popham,T.	AO	8/20-8/24	10	7	74	81
		Kaiser,H. Kangaur,R.	AP	8/21	2		6	6
		Manock,E.	AG	6/26-7/6	7	24	26	50
	Pope & Talbott Inc.	Kincaid,F.	S	6/29	1		9	9
	Weyerhaeuser Timber Co.	Gehrman,R.	AL	7/3	1	2	1	3
		Price,C.	AK	7/5-7/11	2	3	26	29
Lincoln County	O.S.B.F.	Kaiser,H. Kangaur,R.	AP	8/24-8/25	4		14	14
	Tree Farm Management Service	Bradshaw,G.	Y	7/6-7/8	3		40	40
		Bronson,V.	V	7/11	1		5	5
		Hubbard,W.	W	7/10-7/11	2		5	5
	Willamette Valley Lbr.Co.	Payette,R.	N	7/12	1		24	24
Linn County	Fischer Lbr. Co.	Wilt,W.	K	7/6-7/13	3	1	6	7
	Mason, Bruce & Girard	Elmgren,R. Ellis,E. Henzie,K	M	6/27-7/5	9	23	47	70

(Continued)

TABLE 7 (Continued)

Area	Agency	Observer(s)	Symbol	Examination Dates	No. Man Days	No. of Check Plots: Budworm Present	No. of Check Plots: Budworm Absent	No. of Check Plots: Total
Linn County	O.S.B.F.	Kaiser,H. Kangaur,R.	AP	8/23	2		25	25
	Tree Farm Management Service	Bradshaw,G.	Y	7/3	1	1	10	11
		Seymour,L.	Z	6/30-7/10	2	2	9	11
	Weyerhaeuser Timber Co.	Price,C.	AK	7/5-7/11	2	3	8	11
	Willamette Valley Lbr.Co.	Payette,R.	N	7/12	1		19	19
Marion County	Longview Fiber Co.	Loeb,J.	AB	7/5-7/6	2		8	8
	O.S.B.F.	Brockman,C. Popham,T.	AO	8/3	2		19	19
Multnomah County	O.S.B.F.	Brockman,C. Popham,T.	AO	8/2-8/3	4		11	11
Polk County	Tree Farm Management Service	Hubbard,W.	W	7/10-7/11	2		12	12
		Stoebig,R.	X	6/29	1		15	15
	Willamette Valley Lbr.Co.	Smith,C.	AQ	7/7-7/12	2		24	24
Tillamook County	O.S.B.F.	Brockman,C. Popham,T.	AO	8/1	2		5	5
		Kaiser,H. Kangaur,R.	AP	8/4	2		28	28
Washington County	Alcoa Mining Co.	Golden,W.	AC	7/10	1		9	9
	O.S.B.F.	Brockman,C. Popham,T.	AO	8/1	2		37	37
		Kaiser,H. Kangaur,R.	AP	8/1	2		8	8
Yamhill County	L.H.L.Lumber Co.	Adcock,G.	AH	7/10	1		7	7
	O.S.B.F.	Kaiser,H. Kangaur,R.	AP	8/2-8/3	4	1	35	36
Crater Lake N.P.	B.E.& P.Q.	Matthias,J. McCartney,R. Wilson,C.	A	7/28	3		6	6
Mt.Hood N.F. (West Side)	B.E.& P.Q.	Carson,W. Dillon,A. Haglund,H.	B	7/24-7/27	10	32	39	71
Rogue River N.F.	B.E.& P.Q.	Matthias,J. McCartney,R. Wilson,C.	A	6/19-6/22	9	22	22	44

(continued)

TABLE 7 (Continued)

Area	Agency	Observers(s)	Symbol	Examination Dates	No. Man Days	No. of Check Plots: Budworm Present	Budworm Absent	Total
Siskiyou N.F.	B.E.&P.Q.	Matthias,J. McCartney,R. Wilson,C.	A	7/24-7/29	15	17	21	38
Umpqua N.F.	B.E. & P.Q.	Matthias,J. McCartney,R. Wilson,C.	A	7/5-7/7	9	5	16	21
Willamette N.F.	B.E.& P.Q.	Carson,W. Dillon,A. Haglund,H.	B.	7/18-7/21	12	63	43	106
			Subtotal		257	325	1652	1977

TABLE 8. RESULTS OF COOPERATIVE SPRUCE BUDWORM GROUND SURVEY IN EASTERN OREGON - 1950

Area	Agency	Observer(s)	Symbol	Examination Dates	No. Man Days	No. of Check Plots: Budworm Present	Budworm Absent	Total
Deschutes N.F.	B.E.& P.Q. F.S.	Carson,W. Dillon,A. Haglund,H. Brown,A. Koski,R.	B	7/31-8/3	12	36	44	80
Fremont N.F.	B.E.& P.Q.	Carson,W. Dillon,A. Haglund,H.	B	8/7-8/9	8	14	37	51
Klamath County	Weyerhaeuser Timber Co.	Borsting,C. Lauterbach,P. Orr,T.	AI	6/27-7/13	4		18	18
Klamath Indian Reservation	B.E.& P.Q.	Matthias,J. McCartney,R. Wilson,C.	A	7/31-8/1	6		18	18
Mt.Hood N.F. (East Side)	B.E.& P.Q. F.S.	Carson,W. Dillon,A. Haglund,H. Gilbert,W.	B	7/25-7/27	6	25	7	32
Warm Springs Indian Reservation	B.E.& P.Q.	Carson,W. Davison,A. Dillon,A. Haglund,H.	B	7/28	4	33	1	34
			Subtotal		40	108	125	233

TABLE 9. RESULTS OF COOPERATIVE SPRUCE BUDWORM GROUND SURVEY IN WESTERN WASHINGTON - 1950

Area	Agency	Observer(s)	Symbol	Examination Dates	No. Man Days	No. of Check Plots: Budworm Present	Budworm Absent	Total
Clallum County	Rayonier Inc.	Carlson,R.	AO	7/12-7/18	6	1	27	28
	Wash.Div.For.	Johnston,H.	AQ	7/3-7/11	3		28	28
Clark County	Weyerhaeuser Timber Co.	Riddagh,D.	J	7/10	1	2	14	16
Cowlitz County	Wash.Div.For.	Bebe,A.	I	6/29-7/5	2		10	10
	Weyerhaeuser Timber Co.	Ferguson,B.	L	7/3-7/7	3	6	61	67
		Kummer,R.	K	7/3	1		9	9
		Riddagh,D.	J	7/3-7/5	2	1	42	43
Grays Harbor County	Rayonier,Inc.	Schwab,C.	AN	7/7-7/13	5		77	77
	So.Olympic Tree Farm	Looney,W.	AY	7/6-7/13	3		42	42
	Wash.Div.For.	Reed,F.	AM	6/27-6/28	2		25	25
	Weyerhaeuser Timber Co.	Chouinard,M.	AH	7/11	1		27	27
Jefferson County	Crown Zellerbach Corp.	Willison,C.	D	7/5	1		13	13
	Rayonier Inc.	Carlson,R.	AO	7/12	1		5	5
	Wash.Div.For.	Johnston,H.	AQ	6/29	1		2	2
		Morgan,R.	AP	7/5	1		10	10
King County	Wash.Div.For.	Dunlap,R.	AT	6/29	1		6	6
		Morton,L.	BI	7/5-7/6	2		34	34
		Mangan,Patson & Ridgeway	M	7/5-7/7	6	1	19	20
		Ridgeway,J.	BH	7/5-7/6	2		18	18
	Weyerhaeuser Timber Co.	Church,J.	BA	6/27-7/24	3		32	32
		Millan,H. Wytko,J. Wytko,M.,Jr.	N	7/5-7/7	3	2	20	22
Kitsap County	Wash.Div.For.	Rheinburger,R.	AW	6/28-7/4	1		8	8
		Rickey,R.	AV	7/10-7/11	1		4	4
		Tucker,L.A.	AU	7/4	1		2	2
Lewis County	Long-Bell Lbr.Co.	Sandoz,A.	BE	7/13	1		15	15
	Rainier For. Assoc.Inc.	Sedlacek,E.	AI	7/17	1		5	5
	Wash.Div.For.	Blanchard,W.	AJ	7/3	1		6	6
		Hadacek	AL	7/10-7/13	3	3	45	48
		McCray,G.	AK	7/7	1		3	3

(continued)

TABLE 9 (Continued)

Area	Agency	Observer(s)	Symbol	Examination Dates	No. Man Days	No. of Check Plots		
						Budworm Present	Budworm Absent	Total
Lewis County	Weyerhaeuser Timber Co.	Bosquet, V.	Q	7/17	1		5	5
		Alexander, M. Waring	P	7/19-7/23	2		27	27
		Neumen, S.	X	7/9-7/23	3		15	15
Mason County	So. Olympic Tree Farm	Looney, W.	AY	7/6-7/13	2		22	22
	Wash. Div. For.	Grell, H.	AX	6/27-7/18	3		41	41
		Holden, H.	BJ	7/1-7/12	5		37	37
		Rickey, R.	AV	7/14	1		5	5
Pacific County	Wash. Div. For.	Kotula, R.	AS	7/3-7/10	4		26	26
		Long, F.	AR	6/27	1		6	6
	Weyerhaeuser Timber Co.	Bosquet, V.	Q	6/29	3		7	7
		Lauterbach, P Neumen, S.						
		Chouinard, M.	AH	7/12	1		9	9
Pierce County	Wash. Div. For.	Dunlap, R.	AT	6/28	1		3	3
		Mangon, Patson & Ridgeway	M	7/7	3	3	5	8
		Rickey, R.	AJ	7/11	1		8	8
	Weyerhaeuser Timber Co.	Alexander, M. Waring	P	7/19	2		9	9
		Millan, H. Wytko, J. Wytko, M., Jr.	N	7/6-7/7	3	1	12	13
Skagit County	Wash. Div. For.	Anderson, T.	AC	7/7	1		4	4
		Bryson	AD	7/6	1		3	3
		Dickey, D.	AF	7/6	1		6	6
		Foss, J.	AB	7/6	1		8	8
		Hamilton, W.	AG	7/6	1		7	7
		McKay, N.	Z	7/7	1		8	8
		Teeter, L.	AA	7/7	1		4	4
		Turk, C.	AE	7/6	1		3	3
	Weyerhaeuser Timber Co.	Yocum, T.	O	7/13	1		4	4
Snohomish County	Wash. Div. For.	Daniels, S.	BD	7/10-7/11	2		31	31
		Knutsen, H.	BC	7/2-7/12	4		32	32
	Weyerhaeuser Timber Co.	Lindquist, A.	BB	7/3-7/7	4		42	42
		Yocum, T.	O	7/12-7/14	3		28	28

(Continued)

TABLE 9 (Continued)

Area	Agency	Observer(s)	Symbol	Examination Dates	No. Man Days	No. of Check Plots: Budworm Present	Budworm Absent	Total
Thurston County	Wash.Div.For.	Thomson,G.	BG	6/28-7/12	4		17	17
		Ward,H.	BF	6/28-6/29	2		15	15
	Weyerhaeuser Timber Co.	Alexander,M. Waring	P	7/19-7/22	2		24	24
		Bosquet,V.	Q	7/17	1		5	5
		Dick,J.	R	7/11	1	6	11	17
Wahkiakum County	Crown Zellerbach Corp.	Erickson,E.	F	7/14	1		6	6
		Prater,J.	E.	6/28-7/5	2		16	16
	Wash.Div.For.	Little,G.	G.	7/14	1		11	11
		Neth,C.	H.	7/5	1		14	14
Whatcom County	Wash.Div.For.	Both,C.	V	6/28-7/7	2		10	10
		Horn,E.	U	6/23-7/6	2		16	16
		Huleutt,G.	T	7/5-7/6	2		13	13
		Porter,C.	S	6/28-6/29	2		16	16
		Wefer,W.	W	6/27-6/28	2		15	15
Gifford Pinchot N.F. (West Side)	B.E.&P.Q.	Dinehart,P. Watson,H. Wray,C.	C	7/18-7/25	18	6	133	139
Mt. Baker N.F.	B.E.& P.Q.	Dinehart,P. Watson,H. Wray,C.	C	8/2-8/3	8		54	54
	F.S.	Fullington,L						
Olympic N.F.	B.E.& P.Q.	Dinehart,P. Watson,H. Wray,C.	C	7/27-7/28	6		37	37
Snoqualmie N.F. (West Side)	B.E.& P.Q.	Dinehart,P. Watson,H. Wray,C.	C	7/25-8/1	12	1	69	70
Mt. Rainier Nat. Park	B.E.& P.Q.	Dinehart,P. Watson,H. Wray,C.	C	7/25-7/26	6	1	6	7
Fort Lewis Military Res.	B.E.& P.Q.	Matthias,J. McCartney,R. Wilson,C.	A	8/14	3	3	35	38
			Subtotal		196	37	1,549	1,586

TABLE 10. RESULTS OF COOPERATIVE SPRUCE BUDWORM GROUND SURVEY IN EASTERN WASHINGTON - 1950

Area	Agency	Observer(s)	Symbol	Examination Dates	No. Man Days	No. of Check Plots: Budworm Present	No. of Check Plots: Budworm Absent	No. of Check Plots: Total
Klickitat County	B.E.& P.Q.	Matthias,J. McCartney,R. Wilson,C.	A	8/3-8/4	6	8	15	23
	Longview Fiber Co.	Loeb,J.	AZ	7/18-7/19	2	2	25	27
Chelan N.F.	B.E.& P.Q.	Dinehart,P. Watson,H. Wray,C.	C	8/7-8/8	8		81	81
	F.S.	Jacobs,E.						
Gifford Pinchot N.F. (East Side)	B.E.& P.Q.	Dinehart,P. Watson,H. Wray,C.	C	7/17-7/18	6	10	9	19
Snoqualmie N.F. (East Side)	B.E.& P.Q.	Dinehart Watson,H. Wray,C.	C	7/25-8/1	3	6	14	20
Wenatchee N.F.	B.E.& P.Q.	Matthias,J. McCartney,R. Wilson,C.	A	8/8-8/11	19	22	22	44
	F.S. Peshastin Lbr.Co.	Monroe,F. Fishback,R.						
Colville Indian Res.	B.E.& P.Q.	Dinehart,P. Watson,H. Wray,C.	C	8/9-8/10	8		32	32
Yakima Indian Res.	B.E.& P.Q.	Matthias,J. McCartney,R. Wilson,C.	A	8/4-8/7	6	22	19	41
			Subtotal		56	70	217	287
TOTAL ALL AREAS					549	540	3,543	4,083

TABLE 11. SUMMARY OF PARTICIPATION IN THE SPRUCE BUDWORM GROUND SURVEY OF 1950

PARTICIPANTS	OREGON	WASHINGTON
Organizations		
Private Companies	14	6
Public Agencies	4	5
Total Organizations	18	11
Individuals		
From Private Companies	35	29
From State Agencies	6	37
From U. S. Forest Service	2	3
From U. S. Bureau of Land Management	5	0
From U. S. Bureau of Entomology and Plant Quarantine	7	6
From U. S. Indian Service	1	1
Total Individuals	56	76

GENERAL SAMPLING INSTRUCTIONS
Spruce Budworm Survey--1950

Samples are to be taken at intervals of about one to three miles along the route of travel, depending upon variations in stand structure, exposure, and elevation. Samples should be taken at least 200 feet from dusty roads or other disturbed locations. At least 3 samples should be taken in each main drainage.

Collections of budworm brood stages should be made on at least one sampling area in each main drainage. On areas where the budworm is scarce, specimens of the budworm should be collected wherever found. When possible approximately 5 larvae, pupae, or pupal cases from each collection point should be placed in the provided vials and labeled by symbol corresponding to the sampling area.

Location of sampling points are to be plotted on maps by number.

After taking sample, spend about 5 minutes examining branches from several other trees in the immediate vicinity to obtain supplementary information regarding the abundance of the budworm.

Send all forms, maps, collections, etc. to: J. M. Whiteside, Forest Insect Laboratory, 445 U. S. Court House, Portland 5, Oregon

INSTRUCTIONS FOR USING SPRUCE BUDWORM SURVEY FORM

Symbol - Insert letter assigned by supervisor to each observer or survey crew.
Sample - Each observer numbers samples consecutively starting with 1; for example, A1, A2, A3, etc.
Tree Species - Species of tree. DF-Douglas-fir, TF-True fir, S-Spruce.
Stand Age - Designate age of stand by symbol:
O - Old Growth
S - Second Growth R-Reproduction
Designation to be applied to surrounding stand rather than to tree from which sample was taken.
No. of Infested Buds - The total number of attacked buds from three 15-inch sprays from each of three trees at each collection point to be counted and recorded. Webbed needles and evidences of defoliation to be counted whether or not brood is present.
Brood Stage - Number of budworm larvae, pupae or empty pupal cases to be recorded for each sample area. Use the following symbols:
L-Larvae
P-Pupae PC-Pupal Cases
Infestation Present or Absent - Following the random sample, additional observations to be made at the sampling point to obtain supplementary information regarding the budworm infestation.
P-Present A-Absent
Remarks - VERY IMPORTANT. Special observations as to infestation indications that might be seen from the air--color of affected foliage, intensity of defoliation, general appearance of the stand from a distance. Indicate whether insects were collected.

1950 SPRUCE BUDWORM SURVEY

Date _____ Unit _____ Sheet No. _____

Observer _____ Symbol _____

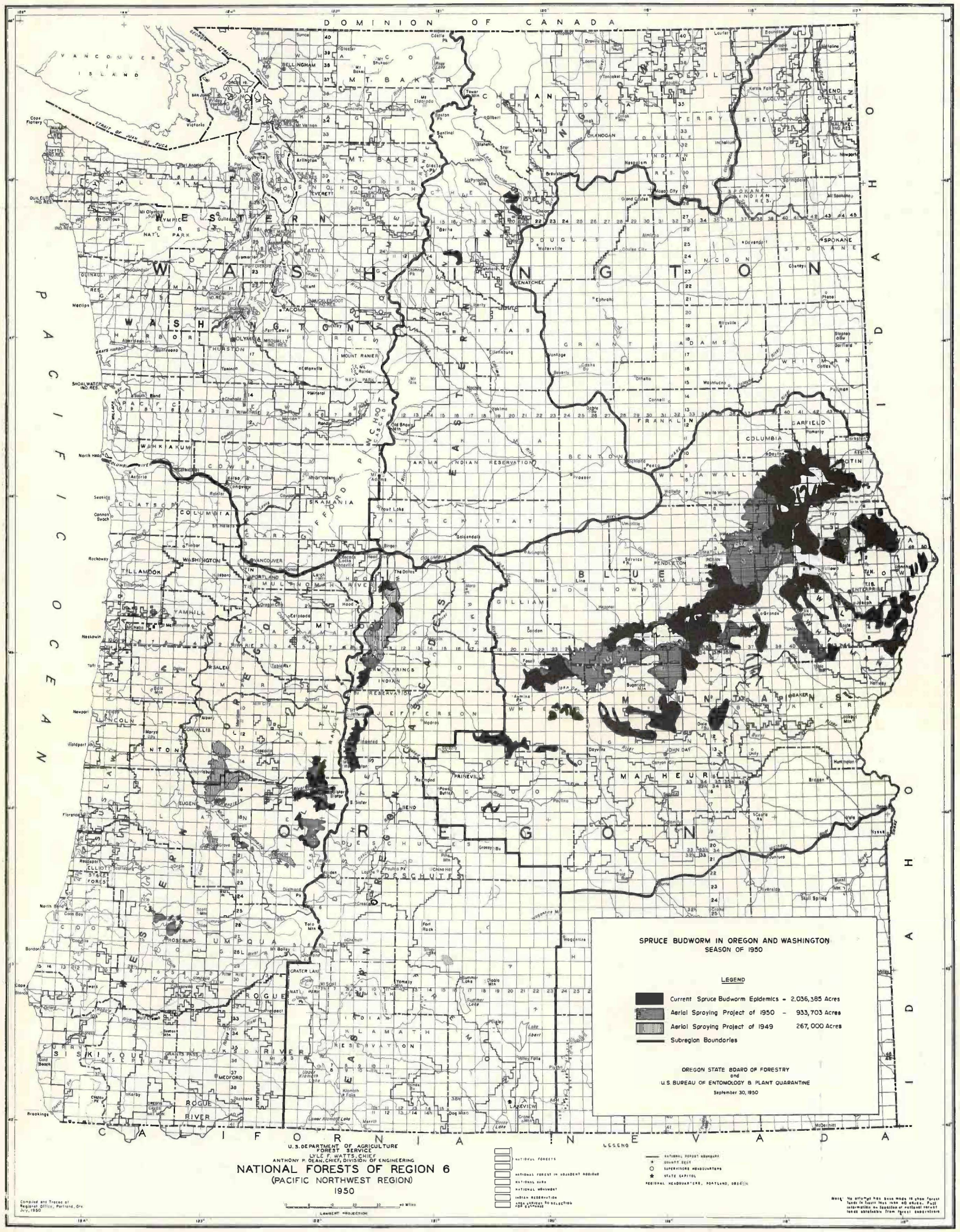
Sample No.	Tree Spp.	Stand Age	No. Infest. Buds	Brood Stage	Infest. Pres. or Absent	Remarks

1950 SPRUCE BUDWORM SURVEY

Date _____ Unit _____ Sheet No. _____

Observer _____ Symbol _____

Sample No.	Tree Spp.	Stand Age	No. Infest Buds	Brood Stage	Infest. Pres. or Absent	Remarks


DOMINION OF CANADA
VANCOUVER ISLAND
PACIFIC OCEAN
IDAHO
CALIFORNIA
NEVADA
WASHINGTON
OREGON
STRAIT OF JUAN DE FUCA
GEORGIA STRAIT
BELLINGHAM
Victoria
Port Angeles
Olympia
Tacoma
Seattle
Everett
Wenatchee
Yakima
Spokane
Pullman
Walla Walla
Kennewick
Richland
Pasco
Ephrata
Moses Lake
Grand Coulee
Omak
Okanogan
Republic
Colville
Kettle Falls
Chewelah
Newport
Davenport
Cheney
Ritzville
Othello
Connell
Prosser
Toppenish
Goldendale
Vancouver
Portland
Astoria
Longview
Kelso
Aberdeen
Hoquiam
Raymond
South Bend
Chehalis
Centralia
Kalama
Woodland
Camas
Washougal
Hood River
The Dalles
Pendleton
Hermiston
Milton-Freewater
La Grande
Baker
Enterprise
Joseph
Wallowa
Elgin
Imbler
Union
Cove
Island City
Summerville
Pilot Rock
Athena
Weston
Adams
Helix
Dayton
Waitsburg
Touchet
Burbank
Kahlotus
Mesa
Connell
Othello
Moses Lake
Soap Lake
Coulee City
Wilbur
Creston
Odessa
Harrington
Sprague
Davenport
Reardan
Edwall
Fairfield
Rockford
Latah
Tekoa
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Juliaetta
Deary
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Potlatch
Princeton
Clarkston
Asotin
Anatone
Grangeville
Kamiah
Orofino
Lewiston
Nezperce
Winchester
Craigmont
Salmon River
Clearwater River
Snake River
Columbia River
Yakima River
Wenatchee River
Okanogan River
Methow River
Chelan River
Lake Chelan
Lake Roosevelt
Grand Coulee Dam
Banks Lake
Potholes Reservoir
Lake Wallula
Lake Sacajawea
Lake Umatilla
Lake Celilo
Lake Billy Chinook
Crooked River
Deschutes River
John Day River
Willamette River
Umpqua River
Rogue River
Klamath River
Upper Klamath Lake
Lower Klamath Lake
Goose Lake
Crater Lake
Diamond Lake
Odell Lake
Lake Abert
Summer Lake
Silver Lake
Fort Rock
Christmas Lake
Paisley
Lakeview
Valley Falls
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Mesquite
Bunkerville
Virgin
Littlefield
Colorado City
Hurricane
Fredonia
Kanab
Page
Lake Powell
Glen Canyon Dam
Navajo Reservoir
Farmington
Shiprock
Cortez
Dolores
Durango
Pagosa Springs
Monte Vista
Alamosa
Del Norte
Creede
Lake City
Gunnison
Crested Butte
Montrose
Ouray
Telluride
Ridgway
Grand Junction
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Delta
Paonia
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Meeker
Rangely
Craig
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Baggs
Encampment
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Buena Vista
Leadville
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Glenwood Springs
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Collbran
Mesa
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Fruita
Loma
Mack
Dinosaur
Vernal
Roosevelt
Duchesne
Myton
Price
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Emery
Green River
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La Sal
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